5780_Postlab_05

Shem Snow

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1 : What does the AUTOEND bit in the CR2 register do? Why don't you want to use it when you'll be needing a restart condition?

The AUTOEND bit is 25th in the I2C CR2 register and it is used to automatically generate a STOP condition (SDA transitions from low-to-high while SCL is maintained high) after "NBYTES" (bits [23:16]) have been transferred. It's useful for writing less code.

In the case of a restart condition, multiple start conditions are sent instead of any stop conditions because WE DO NOT WANT TO RELEASE THE BUS AND ALLOW ANOTHER MASTER TO HIJACK IT. STOP CONDITIONS RELEASE THE BUS FROM THE MASTER AND THE AUTOEND BIT GENERATES STOP CONDITIONS.

2 : This lab used standard-mode 100 kHz I2C speed. What values would you write in the TIMINGR if we were using 400 kHz fast-mode?

Parameter	Fast-mode (Fm) 400 kHz
PRESC	0
SCLL	0x9
t_{SCLL}	10x125 ns = 1250 ns
SCLH	0x3
t_{SCLH}	4x125ns = 500ns
$t_{SCL}^{(1)}$	~2500 ns$^{(3)}$
SDADEL	0x1
t_{SDADEL}	1x125 ns = 125 ns
SCLDEL	0x3
t_{SCLDEL}	4x125 ns = 500 ns

Figure 1: Figure 5.4 in the lab instructions

$I2C2->TIMINGR \mathrel{\&}= (1 << 28);\ //Prescaler = 0$
$I2C2->TIMINGR \mathrel{|}= 0x9 << 0;\ //SCLL = 0x9$
$I2C2->TIMINGR \mathrel{|}= 0x3 << 8;\ //SCLH = 0x3$
$I2C2->TIMINGR \mathrel{|}= 0x1 << 16;\ //SCADEL = 0x1$
$I2C2->TIMINGR \mathrel{|}= 0x3 << 20;\ //SCLDEL = 0x3$

← In code it would look like this.

$I2C2->TIMINGR \mathrel{|}= (0x1 << I2C\_TIMINGR\_PRESC\_Pos);$
$I2C2->TIMINGR \mathrel{|}= (0x9 << I2C\_TIMINGR\_SCLL\_Pos);$
$I2C2->TIMINGR \mathrel{|}= (0x3 << I2C\_TIMINGR\_SCLH\_Pos);$
$I2C2->TIMINGR \mathrel{|}= (0x1 << I2C\_TIMINGR\_SDADEL\_Pos);$
$I2C2->TIMINGR \mathrel{|}= (0x3 << I2C\_TIMINGR\_SCLDEL\_Pos);$

← Which is equivalent to this.

3 : This lab used blocking code. To implement it completely as non-blocking you would replace all of the wait loops with interrupts. Most flags in the I2C peripheral can trigger an interrupt if the proper enable bit is set. Find the interrupt enable bits that match the following flags:

Register Field	Bit position
Transfer complete (TC)	6
Not Acknowledge Received Flag (NACKF)	4
Transmit Interrupt Status (TXIS)	1
Arbitration Lost (ARLO)	9

In code, you would enable the interrupts in the NVIC then set their priority.

4 : The gyroscope can operate in three full-scale/measurement ranges, measured in degrees-per-second (dps). What are these three ranges?

From page 9 on the Gyroscope data sheet:

- 250 dps
- 500 dps
- 2000 dps

The Measurement range is a mechanical characteristic because gyroscopes work via angular acceleration magic.

5 : What is the I2C address of the gyroscope when the SDO pin is low? The lab has the pin set high, read the I2C section of the gyroscope data sheet.

- The gyroscope is the receiver of communication so it is a slave.
- The Slave ADdress (SAD) associated with the L3GD20 is 110101xb.
- The SDO pin can be used to modify the less significant bit of the device address.

If the SDO pin is connected to voltage supply (high), LSb is '1' (address 1101011b). Otherwise, **if the SDO pin is connected to ground, the LSb value is '0' (address 1101010b = 6Ah = 106d)**.